

Patent Claims:

1. Condensation-crosslinking dental material, particularly dental impression material, containing:

a) at least one alkoxysilyl-functional polyether and

b) at least one catalyst,

characterized in that the at least one catalyst b) is a salt that is formed from at least one cation selected from the group consisting of

- complexes of alkali metal or ammonium cations with crown ethers and/or cryptands,
- tetraalkyl-, tetraaryl- trialkylaryl-, dialkyldiaryl-, monoalkyltriarylammonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylphosphonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylarsonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylstibonium cations,

- cations formed by protonation of a base with a pK_{BH^+} value of at least 20 measured in acetonitrile

and combinations thereof, and at least one anion of a saturated and/or unsaturated (cyclo)aliphatic carboxylic acid, with the carboxylic acid being a branched carboxylic acid with a length of the (cyclo)alkyl chain provided on the carboxyl group of at least 2 carbon atoms, or an unbranched carboxylic acid with a length of the (cyclo)alkyl chain provided on the carboxyl group of at least 4 carbon atoms.

2. Condensation-crosslinking two-component dental material, particularly dental impression material, with a component A containing

a) at least one alkoxysilyl-functional polyether

and a component B containing

b) at least one catalyst and

c) water,

wherein the at least one catalyst b) is a salt that is formed from at least one cation selected from the group consisting of

- complexes of alkali metal or ammonium cations with crown ethers and/or cryptands,
- tetraalkyl-, tetraaryl- trialkylaryl-, dialkyldiaryl-, monoalkyltriarylammonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylphosphonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylarsonium cations, tetraalkyl-, tetraaryl-, trialkylaryl-, dialkyldiaryl-, monoalkyltriarylstibonium cations,
- cations formed by protonation of a base with a pK_{BH^+} value of at least 20 measured in acetonitrile

and combinations thereof, and at least one anion of a saturated and/or unsaturated (cyclo)aliphatic carboxylic acid, with the carboxylic acid being a branched carboxylic acid with a length of the (cyclo)alkyl chain provided on the carboxyl group of at least 2 carbon atoms, or an unbranched carboxylic acid with a length of the (cyclo)alkyl chain provided on the carboxyl group of at least 4 carbon atoms.

3. Condensation-crosslinking dental material pursuant to Claim 1, characterized in that it contains at least one reinforcing filler d_1) with a BET surface area of at least $50 \text{ m}^2/\text{g}$ and/or at

least one non-reinforcing filler d₂) with a BET surface area of less than 50 m²/g.

4. Condensation-crosslinking two-component dental material pursuant to Claim 2, characterized in that it contains in component A and/or in component B at least one reinforcing filler d₁) with a BET surface area of at least 50 m²/g and/or at least one non-reinforcing filler d₂) with a BET surface area of less than 50 m²/g.

5. Dental material pursuant to one of the preceding claims, characterized in that the cation of the catalyst salt b) is a complex of lithium, sodium, potassium, rubidium, cesium, and/or ammonium ions and one or more of the crown ethers and/or cryptands selected from the group consisting of: 15-Crown-5, 18-crown-6, dibenzo-18-crown-6, dibenzo-21-crown-7, dibenzo-24-crown-8, dibenzo-30-crown-10, 1,4,10-trioxa-7,13-diazacyclopentadecane, 4,7,13,18-tetraoxa-1,10-diazabicyclo[8.5.5]eicosane, 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane, 3,6,9,14-tetrathiabicyclo[9.2.1]tetradeca-11,13-diene, 1,4,7,10-tetrathiacyclododecane, 1,5,9,13-tetrathiacyclohexadecane-3,11-diol, 1,5,9-triazacyclododecane, 1,4,7-triazacyclononane, 1,4,7,10,13,16-hexamethyl-1,4,7,10,13,16-hexaazacyclooctadecane,

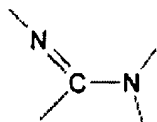
1,4,10-trioxa-7,13-diazacyclopentadecane, 4,7,13,18-tetraoxa-1,10-diazabicyclo[8.5.5]eicosane, 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane, dibenzo-21-crown-7, dibenzo-24-crown-8, dibenzo-30-crown-10, 18-crown-6, 15-crown-5, 3,6,9,14-tetrathiabicyclo[9.2.1]tetradeca-11,13-diene, 1,4,7,10-tetrathiacyclododecane, 1,5,9,13-tetrathiacyclohexadecane-3,11-diol, 1,5,9-triazacyclododecane, and 1,4,7-triazacyclononane.

6. Dental material pursuant to one of the claims 1 to 4, **characterized in that** the cation of the catalyst salt b) is an ion selected from the group consisting of tetramethylammonium, tetraethylammonium, tetrapropylammonium, tetrabutylammonium, tetrapentylammonium, tetrahexylammonium, tetraheptylammonium, tetraoctylammonium, tetranonylammonium, tetradecylammonium, tetramethylphosphonium, tetraethylphosphonium, tetrapropylphosphonium, tetrabutylphosphonium, tetrapentylphosphonium, tetrahexylphosphonium, tetraheptylphosphonium, tetraoctylphosphonium, tetranonylphosphonium, tetradecylphosphonium, tetramethylarsonium, tetraethylarsonium, tetrapropylarsonium, tetrabutylarsonium, tetrapentylarsonium, tetrahexylarsonium, tetraheptylarsonium, tetraoctylarsonium, tetranonylarsonium, tetradecylarsonium, tetramethylstibonium, tetraethylstibonium, tetrapropylstibonium, tetrabutylstibonium, tetrapentylstibonium, tetrahexylstibonium, tetraheptylstibonium, tetraoctylstibonium, tetranonylstibonium, tetradecylstibonium,

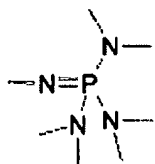
lauryltrimethylammonium, myristyltrimethylammonium, cetyltrimethylammonium, stearyltrimethylammonium, lauralkonium, myristalkonium, cetalkonium, stearalkonium, cetyldimethylammonium, benzyltriethylammonium, and benzalkonium cations, and combinations thereof.

7. Dental material pursuant to one of the claims 1 to 4, characterized in that the cation of the catalyst salt b) is an ion formed by protonation of a base with a pK_{BH^+} measured in acetonitrile of at least 21, preferably at least 22, and very preferably at least 23.

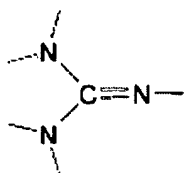
8. Dental material pursuant to Claim 7, characterized in that the catalyst salt b) is formed from a base that has at least one structural unit according to the general formula I



and/or according to the general formula II



and/or according to the general formula III



9. Dental material pursuant to Claim 7 or 8, **characterized in that** the cation used for the catalyst salt b) is a protonated base selected from the group consisting of 1,1,3,3-tetramethylguanidine, diazabicyclo[5.4.0]undec-7-ene, 1,5-diazabicyclo[4.3.0]non-5-ene, tert-butyliminotris(dimethylamino)phosphorane, tert-butyliminotri(pyrrolidino)phosphorane, tert-octyliminotris(dimethylamino)phosphorane, 2-tert-butylimino-2-diethylamino-1,3-dimethylperhydro-1,3,2-diazaphosphorine, 2-tert-butylimino-2-diethylamino-1,3-dimethylperhydro-1,3,2-diazaphosphorine on polystyrene, 1-tert-butyl-2,2,4,4,4-pentakis(diethylamino)-2 Λ 5, 4 Λ 5-catenadi(phosphazene), 1-ethyl-2,2,4,4,4-pentakis(diethylamino)-2 Λ 5, 4 Λ 5-catenadi(phosphazene), 1-tert-butyl-4,4,4-tris(dimethylamino)-2,2-bis[tris(dimethylamino)phosphoranylidene-amino]-2 Λ ⁵, 4 Λ ⁵-catenadi(phosphazene), 1-tert-octyl-4,4,4-tris(dimethylamino)-2,2-bis[tris(dimethylamino)phosphoranylideneamino]-2 Λ ⁵, 4 Λ ⁵-catenadi(phosphazene), 2,8,9-triisobutyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane, 2,8,9-triisopropyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane, 2,8,9-trimethyl-

2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane, 1,8-bis(tetramethylguanidino)naphthalene, 2-tert-butyl-1,1,3,3-tetramethylguanidine, 1,5,7-triazabicyclo(4.4.0)dec-5-ene, 7-methyl-1,5,7-triazabicyclo(4.4.0)dec-5-ene, 1,5-diazabicyclo(4.3.0)dec-5-ene, and 3,3,6,9,9-pentamethyl-2,10-diazabicyclo(4.4.0)dec-1-ene, preferably a protonated base selected from the group consisting of tert-butyliminotri(pyrrolidino)phosphorane, 1-tert-butyl-2,2,4,4,4-pentakis(diethylamino)-2 Λ 5, 4 Λ 5-catenadi(phosphazene), 1-tert-butyl-4,4,4-tris(dimethylamino)-2,2-bis[tris(dimethylamino)phosphoranylidene-amino]-2 Λ ⁵, 4 Λ ⁵-catenadi(phosphazene), tert-octylimino-tris(dimethylamino)phosphorane, 2,8,9-triisopropyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane, 1,5-diazabicyclo[4.3.0]non-5-ene, 1,1,3,3-tetramethylguanidine, diazabicyclo[5.4.0]undec-7-ene, 7-methyl-1,5,7-triazabicyclo(4.4.0)dec-5-ene, 2-tert-butyl-1,1,3,3-tetramethylguanidine, 1,5,7-triazabicyclo(4.4.0)dec-5-ene, and/or 1,8-bis(tetramethylguanidino)naphthalene.

10. Dental material pursuant to one of the preceding claims, characterized in that the anion of the catalyst salt b) is an anion of branched carboxylic acid with a length of the (cyclo)alkyl chain provided on the carboxyl group of at least 3 carbon atoms, more preferably at least 4, and very preferably at least 5 carbon atoms, or an unbranched carboxylic acid with a

length of the (cyclo)alkyl chain provided on the carboxyl group of at least 5 carbon atoms, with appropriate anions of (cyclo)aliphatic monocarboxylic acid being most highly preferred.

11. Dental material pursuant to one of the preceding claims, **characterized in that** the anion of the catalyst salt b) is a deprotonated saturated and/or unsaturated (cyclo)aliphatic carboxylic acid whose (cyclo)alkyl chain has at least one branch, preferably at least two branches, in the γ -position, more preferably in the β -position, and very preferably in the α -position relative to the carboxyl group.

12. Dental material pursuant to one of the preceding claims, **characterized in that** the anion of the catalyst salt b) is an ion selected from the group consisting of deprotonated 2,2-dialkylalkanoic acids, 3,3-dialkylalkanoic acids, 4,4-dialkylalkanoic acids, 2,3-dialkylalkanoic acids, 2,4-dialkylalkanoic acids, 3,4-dialkylalkanoic acids, 2,2-dialkylalkenoic acids, 3,3-dialkylalkenoic acids, 4,4-dialkylalkenoic acid, 2,3-dialkylalkenoic acids, 2,4-dialkylalkenoic acids, 3,4-dialkylalkenoic acids, 2,2-dialkylalkynoic acids, 3,3-dialkylalkynoic acids, 4,4-dialkylalkynoic acids, 2,3-dialkylalkynoic acids, 2,4-dialkylalkynoic acids, 3,4-dialkylalkynoic acids, 2-monoalkylalkanoic acids, 3-monoalkylalkanoic acids, 4-

monoalkylalkanoic acids, 2,2-dialkylhexanoic acids, preferably 2,2-dialkylnonanoic acid, 2,2-dimethyldecanoic acid, 2,2-diethyldecanoic acid, 2,2-dipropyldecanoic acid, 2,2-dibutyldecanoic acid, 2,2-dimethylnonanoic acid, 2,2-diethylnonanoic acid, 2,2-dipropylnonanoic acid, 2,2-dibutylnonanoic acid, 2,2-dimethyloctanoic acid, 2,2-diethyloctanoic acid, 2,2-dipropyloctanoic acid, 2,2-dibutyloctanoic acid, 2,2-dimethylheptanoic acid, 2,2-diethylheptanoic acid, 2,2-dipropylheptanoic acid, 2,2-dibutylheptanoic acid, 2,2-dimethylhexanoic acid, 2,2-diethylhexanoic acid, 2,2-dipropylhexanoic acid, 2,2-dibutylhexanoic acid, 2-butyloctanoic acid, 2-hexyldecanoic acid, 2-propylpentanoic acid, 1-methyl-1-cyclohexanecarboxylic acid, 2,2-dimethylbutyric acid, 2,2-dimethylvaleric acid, 3,5,5-trimethylhexanoic acid, 2-ethylhexanoic acid, decanoic acid, octanoic acid, hexanoic acid, and enanthic acid.

13. Dental material pursuant to one of the preceding claims, **characterized in that** based on the total mixture, it contains at least one catalyst b) in the amount of 0.001 to 1 mmol/g, preferably 0.001 to 0.5 mmol/g, more preferably 0.001 to 0.1 mmol/g, and most highly preferably 0.005 to 0.05 mmol/g.

14. Dental material pursuant to one of the preceding claims, **characterized in that** the catalyst salt used in the polyether

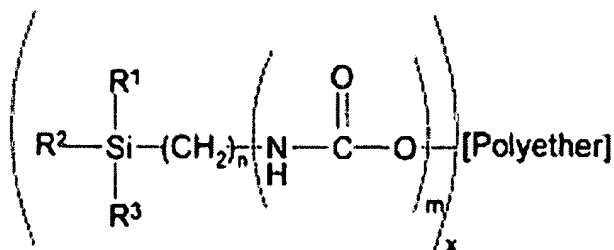
matrix has sufficiently high solubility when used in amounts of 0.001 to 1 mmol/g based on the total mixture, to produce hardening of the dental material, determined by recovery after deformation according to ISO 4823 (1992 version) in 30 minutes or less, preferably 15 minutes or less for a prosthodontic composition, and in 15 minutes or less, preferably 10 min or less, more preferably 7 min or less, and most highly preferably 6 min or less for a dental impression composition.

15. Dental material pursuant to Claim 2, **characterized in that** it contains as catalyst b) at least one salt of 1,8-diazabicyclo[5.4.0]undec-7-ene, 1,5-diazabicyclo[4.3.0]non-5-ene, and/or 1,1,3,3-tetramethylguanidine, with 2-ethylhexanoic acid.

16. Dental material pursuant to one of the preceding claims, **characterized in that** it contains no other catalyst besides one or more salts according to one of the claims 1 to 15, in particular no metal-organic compounds, no heavy metal carboxylate salts, tertiary amines, or free acids.

17. Dental material pursuant to one of the preceding claims, **characterized in that** the at least one polyether a) has a third structural unit of alkylene spacers, each located on the terminal alkoxysilyl groups, which are preferably C₁-C₆ alkyl groups, with special preference C₁-C₃ alkyl groups, and very preferably

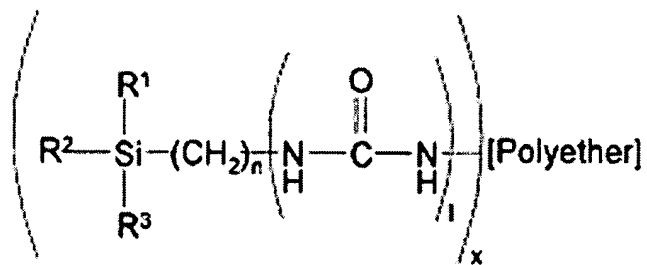
ethylene groups (C_2) and/or methylene groups (C_1), and as a fourth structural unit has 0 to 8 mmol/g, with special preference 0 to 4 mmol/g, with very great preference 0.02 to 2 mmol/g, and most preferably 0.1 to 0.4 mmol/g of urethane groups and/or 0 to 8 mmol/g, with special preference 0 to 2 mmol/g, with very great preference 0.02 to 2 mmol/g, and most preferably 0.1 to 0.4 mmol/g of urea groups, with alkoxysilylpolyethers being most highly preferred that contain no urethane and/or urea groups within the polymer chain, and that carry at most one or no more than one urethane and/or urea group, and at most one or no more than one methylene spacer group, at each end of the chain, with the individual structural units of the at least one polyether a) preferably being arranged according to



wherein R^1 , R^2 , and R^3 independently of one another are alkoxy, alkyl, aryl, aralkyl, alkylaryl groups, or hydrogen, preferably butoxy, propoxy, ethoxy, methoxy, hexyl, pentyl, butyl, propyl, ethyl, or methyl groups, with special preference ethoxy, methoxy, ethyl, or methyl groups, provided

that at least one of the aforementioned residues, preferably two or all three residues, are alkoxy groups, and
 $x=1$ to 6, preferably $x=2$ to 4, and with special preference $x=2$, $n=1$ to 6, preferably $n=1$ to 3, and with special preference $n=1$, and $m=0$ or 1, with special preference $m=1$,

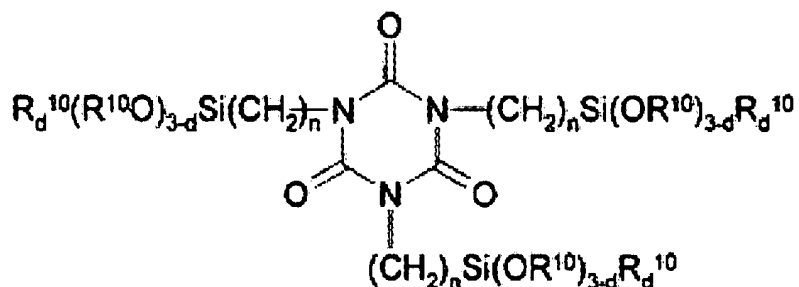
and/or



wherein R^1 , R^2 , and R^3 independently of one another are alkoxy, alkyl, aryl, aralkyl, alkylaryl groups, or hydrogen, preferably butoxy, propoxy, ethoxy, methoxy, hexyl, pentyl, butyl, propyl, ethyl, or methyl groups, with special preference ethoxy, methoxy, ethyl, or methyl groups, provided that at least one of the aforementioned residues, preferably two or all three residues, are alkoxy groups, and
 $x=1$ to 6, preferably $x=2$ to 4, and with special preference $x=2$, $n=1$ to 6, preferably $n=1$ to 3, and with special preference $n=1$, and $l=0$ or 1, and with special preference $l=1$.

18. Dental material pursuant to Claim 17, characterized in that n is equal to 1.

19. Dental material pursuant to one of the preceding claims, characterized in that it contains at least one water scavenger g), preferably a water scavenger selected from the group consisting of alkoxysilanes, titanates, zirkonates, zeolites, aluminum sulfate, anhydrous calcium sulfate, Blue Gel, oxazolidines, alkoxysilanes, and with special preference selected from the group consisting of vinyltrimethoxysilane, N-trimethoxysilylmethyl-O-methylcarbamate, and



wherein n = 1 to 6, preferably n = 1 or 3, more preferably n = 1, d = 0 or 1, and

R¹⁰ = a linear or branched C₁-C₃₀ alkyl residue in which the hydrogen atoms may be partially substituted by halogen atoms, OH-, NH₂-, NO₂-, or other C₁-C₆ alkyl residues.

20. Dental material pursuant to one of the preceding claims, characterized in that it contains at least one paste-former h), preferably a paste-former selected from the group that consists of polyethers, polyvinylpyrrolidones, polyurethanes, polyesters, waxes, vaseline, paraffin oils, silicone oils, polyfunctional alcohols, propylene glycols, polypropylene glycols, ethylene glycols, polyethylene glycols, copolymers of N-vinylpyrrolidone and vinyl acetate, carboxymethyl-, methyl-, hydroxyethyl-, and hydroxypropylcellulose, polysaccharides, glycerin, and poly(meth)acrylic acids.

21. Mixture obtainable by mixing components A and B of the two-component dental material pursuant to one of the claims 2 to 20, characterized in that the base component A is mixed with the catalyst component B in a ratio of 1:1 to 20:1, preferably from 1:1 to 10:1, and very preferably 1:1, 2:1, 4:1, or 5:1.

22. Use of a dental material pursuant to one of the claims 1 to 21 in dentistry and/or dental technology.